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Please file the following enclosed patent application papers:

Applicant #1, Name: **ALEKSANDR L. YUFA**
Other Applicant(s): N/A
Title: **"METHODS AND WIRELESS COMMUNICATING APPARATUS FOR PRECISE ANALYZING OF ENVIRONMENT".**

The PTO did not receive the following listed item(s) POST CARD

(X) Specification, Claims and Abstract: **37 sheets** (including **4 sheets** of the drawing refer. numer. worksheet)

(X) Declaration for Utility Patent Application: **1 sheet,** Date Signed: **JANUARY 29, 1998**

(X) Drawing(s): Number of Sheets Enclosed: (In Triplicate): **30 sheets:** Formal: **10 sheets** Informal:: **20 sheets**

(X) Small Entity Declaration of Inventor: **1 sheet**

(X) Petition to Make Special: **1 sheet**

(X) Declaration in Support of Accompanying Petition to Make Special: **3 sheets**

(X) Information Disclosure Statement: **1 sheet**

(X) Form-1449 and the Pertinent Parts of the References: **25 sheets**

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Very respectfully,

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09/015950

Declaration for Utility Patent Application

As a below-named inventor, I hereby declare that my residence, post office address, and citizenship are as stated below next to my name and that I believe that I am the original, first, and sole inventor [if only one name is listed below] or an original, first, and joint inventor [if plural names are listed below] of the subject matter which is claimed and for which a patent is sought on the invention, the specification of which is attached hereto and which has the following title:

"METHODS AND WIRELESS COMMUNICATING APPARATUS FOR PRECISE ANALYZING OF ENVIRONMENT"

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to in the oath or declaration. I acknowledge a duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Title 18, United States Code, Section 1001, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Please send correspondence and make telephone calls to the Inventor below.

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In the United States Patent and Trademark Office

Sole Applicant: **ALEKSANDR L. YUFA**
Other Applicant(s): N/A
Title: **"METHODS AND WIRELESS COMMUNICATING APPARATUS FOR PRECISE ANALYZING OF ENVIRONMENT"**

Small Entity Declaration - Independent Inventor

As a below-named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under Section 41(a) and (b) of Title 35 United States Code, to the Patent and Trademark Office with regard to my above-identified invention described in the specification filed herewith. I have not assigned, granted, conveyed, or licensedand am under no obligation under any contract or law to assign, grant, convey, or license any rights in the invention to either (a) any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or (b) any concern which would not qualify as either (i) a small business concern under 37 CFR 1.9(d) or (ii) a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

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( ) Any applicable person, concern, or organization is listed below:

Full Name: N/A
Address: N/A

I acknowledge a duty to file, in the above application for patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b)).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

	ALEKSANDR L. YUFA	January 23, 1998
Signature	Name	Date

Utility Patent Application of ALEKSANDR L. YUFA

for

METHODS AND WIRELESS COMMUNICATING APPARATUS FOR PRECISE ANALYZING OF ENVIRONMENT

FIELD OF THE INVENTION

This invention relates to air, gas and liquid quality and, more particularly, to devices, apparatus and instruments for airborne particle quantity counting and particle size measuring by light (laser) beam.

BACKGROUND OF THE INVENTION

The methods and devices for determining quantity and size of the particles and/or liquid (water) contaminations are now well known, and it is also well known that powerful light or laser and detecting system can be, and have been used to achieve particle size and particle quantity measurements. Such devices, mostly using microprocessor processing systems and/or computers, are well known and described, for example, in the articles: R.G.Knollenberg, B.Schuster--"Detection and Sizing of Small Particles in Open Cavity Gas Laser," Applied Optics, Vo.11, No.7, November 1972, pp.1515-1520; R.G.Knollenberg--"An Active Scattering Aerosol Spectrometer," Atmospheric Technology, No.2, June 1973, pp.80-81; Schehl, Ergun, Headrick--"Size Spectrometry of Aerosols Using Light Scattering from the Cavity of a Gas Laser," Review of Scientific Instruments, Vol. 44, No. 9, September 1973; R.G.Knollenberg--"Active Scattering Aerosol

Spectrometry,"National Bureau of Standards Special Publication, No.412, October 1974, pp.57-64; R.G.Knollenberg, R.E.Luehr--"Open Cavity Laser 'Active' Scattering Particle Spectrometry from 0.05 to 5.0 Microns," Fine Particles, Aerosol Generation Measurement, Sampling and Analysis, Academic Press, May 1975, pp.669-696; R.G.Knollenberg--"Three New Instruments for Cloud Physics Measurements: The 2-D Spectrometer, the Forward Scattering Spectrometer Probe, and the Active Scattering Aerosol Spectrometer," American Meteorological Society, International Conference on Cloud Physics, July 1976, pp. 554-561; R.G.Knollenberg --"The Use of Low Power Laser in Particle Size Spectrometry", Proceeding of the Society of Photo-Optical Instrumentation Engineers, Practical Applications of Low Power Lasers, Vo.92, August 1976, pp.137-152; Elterman--"Brewster Angle Light Trap," Applied Optics, Vol. 16, No. 9, September 1977; Marple--"The Aerodynamics Size Calibration of Optical Particle Counters by Inertial Impactors," Aerosol Measurement, 1979; Diehl, Smith, Sydor--"Analysis by Suspended Solids by Single-Particle Scattering," Applied Optics, Vol. 18, No. 10, May 1979; K.Suda--Review of Scientific Instruments, Vol. 51, No. 8, August 1980, pp.1049-1058; R.G.Knollenberg--"The Measurement of Particle Sizes Below 0.1 Micrometers", Journal of Environment Science, January-February, 1985, pp. 64-67; Peters--"20 Good Reasons to Use In Situ Particle Monitors", Semiconductor International, Nov. 1992, pp.52-57 and Busselman et al.--"In Situ Particle Monitoring in a Single Wafer Poly Silicon and Silicon Nitride Etch System", IEEE/SEMI Int'l Semiconductor Manufacturing Science Symposium, 1993, pp.20-26.

The reference in these articles is made to the devices and methods of particle measurement, utilizing an open cavity laser for particle detection and the subsequent detected signal processing by a signal processing system (mostly by the microprocessor system).

All known methods and devices use the detecting means mostly with imaging systems, which can be based on the scattered light collection, as it is mentioned, for example, in U.S. Patent No. 4,140,395, U.S. Patent No. 4,798,465, U.S. Patent No. 5,467,189 and in 5,515,164 of the prior art.

For example, in U.S. Patent No. 4,140,395 and in U.S. Patent No.4,798,465 of the prior art are used the imaging systems, which are based on lenses

Yet in other prior art (for example, such as U.S. Patent No. 5,467,189 and U.S. Patent No. 5,515,164) we can find the devices (sensors) with ellipsoidal mirrors instead of the lens systems or non-divergent quadric mirrors.

All these devices, mentioned in the prior art above, use light scattering focalizing methods. Such methods are based on the collection of the scattered light. A light scattering occurs at the first focal point (focus) by particles in the laser beam. Considering stochastic dispersion of the scattered light, the devices, mentioned in the above prior art, use mirrors or optics. This is necessary for scattered light collecting and focalizing at the second focal point (focus), where a light detector is placed and intended for scattered light detection.

Also the devices, based on scattered light collection and some other detection methods (for

example by light splitting), use a different variations of the comparison method for the particle size measuring. Such method can be illustrated (see Fig.1), for example, by U.S. Patent No.4,798,465. On Fig.1 is shown the particle size detection device, using one of the particle measuring comparison method variations. The signal from detectors 1 via the amplifiers 61 follow to the comparators 62, which is connected to the reference voltage means 63. The amplified detected signals are compared with the predetermined different reference voltages for the particle size qualifying.

Such methods cannot provide sufficiently high sensitivity related to the increasing requirements.

Another and also important deficiency of all known particle analyzing devices is the use of the wire leads (cable) for the particle detecting system connection to the data processing and control system (computer) for the further data processing, data displaying and analyzing.

The devices, using the wire (cable) connection of the particle detecting system with the data processing and control system, can be presented by two styles of their configuration: a portable configuration of the particle analyzing device, being an entire unit containing particle detecting means (sensor) connected by short wires (short cable) to the microprocessor means, or a remote sensor configuration of the particle analyzing device, wherein, for example, the sensor and the data processing means (microprocessor) are represented by two separated and remote of each other units connected by long wires (long cable).

On Fag.2 is shown, for example, a device (see U.S. Patent No. 5,524,129) with the wire (cable) connection 35 of the sensor 75 with the microprocessor (CPU) 76.

It is known, that all wire (cable) connections in electronic apparatus are a source of the electromagnetic noise, which can create a distortion of the signals. Also the portable devices require local operation with them and exactly in the place of the airborne particle or liquid (water) contaminations assaying. The devices with long cable connection between the remote sensor and the data processing means have a limited mobility, because of cable.

For example, it is known, that integrated circuits (chips) and semiconductors have been produced in "clean rooms". The air in such "clean rooms" should be very well cleaned. The continuing tendencies of improvement in circuit integration and degree of microminiaturization require corresponding improvements of the environment in "clean rooms" and efficiency and sensitivity of the measuring devices. And now, as it is known, the sensitivity of the counting and measuring devices should be at least as small as 0.1μm (Micron). Such rate requires minimum distortions in the detected signals and processing information. Also the measurements should be done in the different places of the semiconductor production areas of "clean rooms"and sometimes in the areas, which could be difficult to approach. The same is regarding the pharmaceutical and biological industries, where is required the well condition of the environment.

Thus, the comparison method of the particle size measuring (an analog comparison of the detected signal amplitudes with the appropriate reference voltages) and the wire (cable) connec-

tions between sensors (particle detecting means) and the microprocessor data processing means (computers) create an insufficient signal to noise ratio, thereby limiting the sensitivity and efficiency of the particle analyzers and also the long wire (cable) connection, using for known remote sensor performance, limits the mobility of the particle counting and measuring means.

OBJECT AND ADVANTAGES OF THE INVENTION

Accordingly, several objects and advantages of the present invention are to provide an improved methods and apparatus for airborne particle and/or liquid (water) contamination analysis.

It is the object of the invention to provide an improved methods and apparatus for increasing the sensitivity of the analyzing means and precision of the complete information.

It is another object of the invention to provide an improved methods and apparatus for increasing the efficiency of the analyzing process.

It is yet another object of the invention to provide an improved method and apparatus for decreasing electromagnetic noises by the elimination of wire (cable) connection between sensors and data processing means.

It is still further an object of the invention to provide an improved methods and apparatus for increasing the authenticity of the information about air or liquid (water) composition.

It is still another object of the invention to provide an improved method and apparatus for increasing the mobility, compactness and convenient placement possibility of the remote detecting

means.

Still, further objects and advantages will become apparent from a consideration of the ensuing description accompanying drawings.

DESCRIPTION OF THE DRAWING

Fig.1 is a presentation of the particle size detecting device (a prior art).

Fig.2 is a presentation of portable counter (a prior art).

Fig.3 is a presentation of the simplified structural schematic of an improved apparatus for precise analyzing of environment.

Fig.4 is a presentation of the simplified detailed block-schematic of an improved apparatus for precise analyzing of environment.

Fig.5 is a presentation of the simplified block-schematic of the remote detecting system of an improved apparatus for environment analyzing.

Fig.6 is a presentation of the simplified block-schematic of the particle detecting system of an improved apparatus for precise analyzing of environment.

Fig.7 is a presentation of the simplified block-schematic of the conversion system of an improved apparatus for precise analyzing of environment.

Fig.8 is the presentation of the simplified block-schematic of an improved apparatus portion, providing an improved method of the light detected signal processing.

Fig.9 is a timing diagram.

Fig.10 is a presentation of the simplified structural schematic of an improved wireless communicating complex for precise analyzing of environment.

On Fig.1 are shown: 1 - the detectors (D); 60 - a detection unit (DU); 61 - the amplifiers; 62 - the comparators; 63 - a reference voltage means ($V_{REF.}$); 65 - a control logic; 66 - a pulse height analyzer.

On Fig.2 are shown: 35 - a wire (cable); 75 - a sensor; 76 - a microprocessor (CPU).

On Fig.3 are shown: 4 - a particle detecting system (PDS); 5 - a remote detecting system (RDS); 13 - a remote data processing and control system (DPCS); 27 - a microprocessor system (MPS); 36 - a wireless communication means (WCM) of the remote detecting system 5; 56 - a wireless communication means (WCM) of the remote data processing and control system 13.

On Fig.4 are shown: 3 - a transmitting-receiving means (TRM) of the wireless communication means 36; 4 - a particle detecting system; 5 - a remote detecting system; 6 - a microprocessor means (MPM); 7 - a multiplexed bus of the remote data processing and control system 13; 8 - a displaying means (DM); 9 - a floppy disk means (FDM); 10 - a compact disk means

(CDM); 11 - a printing means (PRM); 12 - a control panel (CP); 13 - a remote data processing and control system; 27 - a microprocessor system; 34 - an aerial means (AM) of the wireless communication means 36; 36 - a wireless communication means of the remote detecting system 5; 38 - a terminal means (TM); 39 - a conversion means (Conv.M) of the microprocessor system 27; 56 - a wireless communication means of the remote data processing and control system 13; 57 - an aerial means of the wireless communication means 56; 58 - a transmitting-receiving means of the wireless communication means 56.

On Fig.5 are shown: 3 - a transmitting-receiving means of the wireless communication means 36; 4 - a particle detecting system; 5 - a remote detecting system; 29 - a transmitting means (TM); 30 - a receiving means (RM); 31 - a conversion system (CS); 32 - a signal processing system (SPS); 33 - a particle detecting means (PDM); 34 - an aerial means of the wireless communication means 36; 36 - a wire less communication means of the remote detecting system 5.

On Fig.6 are shown: 31 - a conversion system; 32 - a signal processing system; 33 - a particle detecting means; 37 - a tubular means; ; 40 - a detection means (De.M); 41 - an environment assaying control means (EACM); 42 - a detected

ted signal processing means (DSPM); 43 - a control means (CM); 44 - a signal processing means (SPM); 45 - a control signal conversion means (CSCM); 51 - a coding-decoding means (C-DM); 59 - a multiplexed bus of the remote detecting system 5; 64 - a conversion means (Conv.M) of the conversion system 31.

On Fig.7 are shown: 31 - a conversion system; 51 - a coding-decoding means; 64 - a conversion means of the conversion system 31.

On Fig.8 are shown: 32 - signal processing system; 33 - a particle detecting system; 40 - a detection means; 42 - a detected signal processing means; 44 - a signal processing means; 67 - a light detecting means (LDM); 68 - a light detecting system (LDS); 69 - a current-voltage conversion means (CVCM); 70 - an amplifying means (Am.M); 71 - a voltage-pulse duration conversion means (VDCM); 72 - a conjunction means (&); 73 - a strobe pulse generating means (SPGM); 74 - a selecting, sorting and counting means (SCM).

On Fig.10 are shown: 13 - a remote data processing and control system; 14 - a first remote detecting system (RDS-1); 15 - a second remote detecting system (RDS-2); 16 - an i-th remote detecting system (RDS-i); 17 - a n-th remote

detecting system (RDS-n); 18 - a particle detecting system the(PDS-1) of the first remote detecting system 14; 19 - a particle detecting system (PDS-2) of second remote detecting system 15; 20 - a particle detecting system (PDS-i) of the i-th remote detecting system 16; 21 - a particle detecting system (PDS-n) of the n-th remote detecting system 17; 22 - a transmitting-receiving means (TRM-1) of the first remote detecting system 14; 23 - a transmitting-receiving means (TRM-2) of the second remote detecting system 15; 24 - a transmitting-receiving means (PDS-i) of the i-th remote detecting system 16; 25 - a transmitting-receiving means (PDS-n) of the n-th remote detecting system 17; 26 - a central transmitting-receiving means (CTRM); 27 - a microprocessor system; 28 - a central aerial means (CAM); 46 - a wireless communication means (WCM-1) of the first remote detecting system 14; 47 - a wireless communication means (WCM-2) of the second remote detecting system 15; 48 - a wireless communication means (WCM-i) of the i-th remote detecting system 16; 49 - a wireless communication means(WCM-n) of the n-th remote detecting system 17; 50 - a central wireless communication means (CWCM); 52 - an aerial means (AM-1) of the first remote detecting system 14; 53 - an

aerial means (AM-2) of the second remote detecting system 15; 54 - an aerial means (AM-i) of the i-th remote detecting system 16; 55 - an aerial means (AM-n) of the n-th remote detecting system 17.

SUMMARY OF THE INVENTION

The invention provides a methods and wireless communicating apparatus for precise analyzing of environment, having a wireless communication means, intended for two-way communication of the remote particle detecting system(s) with a remote data processing and control system.

The improved methods of environment analyzing provide airborne particle and/or liquid contamination counting and measuring, eliminating an analog comparison of the detected signal amplitudes with the appropriate reference voltages and also eliminating the wire (cable), connecting the particle detection system with the data processing and control system. An improved apparatus, realizing the improved methods, includes a remote detecting system, comprising a particle detecting system and a wireless communication means of the remote detecting system, and a remote data processing and control system, comprising a microprocessor system and a wireless communication means of the remote data processing and control system. The control signals from a remote data processing and control system are transmitted by the two-way wireless communication means of the remote data processing and control system to the two-way wireless communication means of the remote detecting system. Further the signals from two-way

wireless communication means of the remote detecting system via the appropriate conversion means of the remote detecting system follow to the control means. The control means provide a control (for example, switching operations) of the environment assaying control means (for example, air/liquid pumps, flowmeter, etc.), which by tubular means transfer an assayed composition to the detection means.

The primer processing of the detected signals provides by timing method. The detected signals are amplified and strobed by strobe pulses. The selecting, sorting and counting means select and sorts the strobe pulse packages by strobe pulse quantity inside each package and also counts quantity of the strobe pulses within the strobe pulse package (particle size) and quantity of the identical packages (particle quantity).

The primarily processed detected signals, containing an information about particle characteristics (size and quantity), are conversed in the data, which is transmitted by two-way wireless communication means of the remote detecting system to the wireless communication means of the remote data processing and control system. Further the signals from two-way communication means of the remote data processing and control system via the appropriate conversion means of the remote data processing and control system follow to the microprocessor system for data processing. The processed data is indicated to the operator in the comprehensive informative form by terminal means (for example, by a display means or by a printing means).

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Here the description of an improved apparatus will be done in statics (as if the components of the improved apparatus are suspended in the space) with description of their relative locations and connections to each other. The description of the improved methods and functional operations of an improved apparatus will be done hereafter.

Fig.3 illustrates a structure of the wireless communicating apparatus for precise analyzing of environment (for counting and measuring particles), including a remote detecting system 5, having a particle detecting system 4 connected to a wireless communication means 36 of the remote detecting system 5, and a data processing and control system 13, having a microprocessor system 27 connected to a wireless communication means 56 of the remote data processing and control system 13.

Fig.4 presents the detailed block-schematic of the wireless communicating apparatus for counting and measuring particles, comprising a remote detecting system 5, which includes a particle detecting system 4 and a wireless communication means 36, having an aerial means 34 connected to a transmitting-receiving means 3. The transmitting-receiving means 3 is connected to a particle detecting system 4. Also the wireless communicating apparatus for counting and measuring particles comprises a remote data processing and control system 13, which includes a wireless communication means 56 and microprocessor system 27, having a microprocessor means 6, a conversion means 39 and terminal means 38. The wireless communication means 56 inc-

ludes an aerial means 57 connected to a transmitting-receiving means 58. The transmitting-receiving means 58 connected to the conversion means 39 of the microprocessor system 27. The terminal means 38 can include a displaying means 8, a floppy disk means 9, a compact disk means 10, a printing means 11 and a control panel 12 (for example, a keyboard), which are connected to each other, to the microprocessor means 6 and to the conversion means 39 by a multiplexed bus 7 (can be used a data bus and an address bus, which are not shown).

Referring to Fig.5, the remote detecting system 5 comprises a particle detecting system 4, having a particle detecting means 33 connected to a signal processing system 32, which is connected to a conversion system 31. Also the remote detecting system 5 comprises a wireless communication means 36, having an aerial means 34 connected to a transmitting means 29 and to a receiving means 30 of the transmitting-receiving means 3. The conversion means 31 of the particle detecting system 4 is connected to the transmitting means 29 and to receiving means 30.

Fig.6 illustrates the detailed block-schematic of the particle detecting system 4, which comprises a conversion system 31, having a conversion means 64 and a coding-decoding means 51 connected either by a multiplexed bus 59 (can be used a data bus and an address bus - not shown), if the conversion means 64 comprises a buffered memory means (not shown), or by a regular connection, as it is shown on Fig.7. Also the particle detecting system 4 comprises a signal processing system 32 and a particle detecting means 33. The signal processing system 32 includes a detected signal processing means 42 connected to a signal processing means 44, which is con-

nected to a control signal conversion means 45 and to the coding-decoding means 51 of the conversion system 31. The control signal conversion means 45 is connected to a control means 43 and to the coding-decoding means 51 of the conversion system 31. The particle detecting means 33 includes a detection means 40, connected to the detected signal processing means 42 of the signal processing system 32, and an environment assaying control means 41, which is connected to the control means 43 of the signal processing system 32 and to the signal processing means 44 of the signal processing system 32. Also the environment assaying control means 41 is coupled to the detection means 40 by a tubular means 37.

Fig.7, as it has been mentioned of the above (see description of the Fig.6), presents a regular connection (not by a bus) of the conversion means 64 and the coding-decoding means 51 of the conversion system 31.

On Fig.8 is shown the improved apparatus portion, which realizes an improved method of the environment analyzing, using the timing detected signal processing. Referring to Fig.8, a light detecting means 67 of the light detecting system 68, belonging to the detection means 40, is connected to a current-voltage conversion means 69 (if the primer signals light of the detecting means are presented in the current value). The current-voltage conversion means 69 of the detected signal processing means 42 via an amplifying means 70 is connected to a voltage-pulse duration conversion means 71, which is connected to a conjunction means 72 of the signal processing means 44. The strobe pulse generating means 73 is also connected to the conjunction

means 72, which is connected to a selecting, sorting and counting means 74.

Fig.9 presents a timing diagram of the detected signal processing steps, which will be described hereafter.

On the Fig.10 is presented a structural schematic of the wireless communicating complex for precise analyzing of environment, which comprises "N" (where N = 1, 2, ..., i, ..., n) remote detecting systems and a remote data processing and control system 13. "N" remote detecting systems are presented on Fig.10 by: a first remote detecting system 14 (RDS-1), a second remote detecting system 15 (RDS-2), an i-th remote detecting system 16 (RDS-i) and a n-th remote detecting system 17 (RDS-n). The first remote detecting system 14 includes a wireless communication means 46, having a transmitting-receiving means 22 connected to an aerial means 52, and a particle detecting system 18 connected to the transmitting-receiving means 22. The second remote detecting system 15 includes a wireless communication means 47, having a transmitting-receiving means 23 connected to an aerial means 53, and a particle detecting system 19 connected to a transmitting-receiving means 23. The i-th remote detecting system 16 comprises a wireless communication means 48, including a transmitting-receiving means 24 connected to an aerial means 54, and a particle detecting system 20 connected to the transmitting-receiving means 24. The n-th remote detecting system 17 includes a wireless communication means 49, comprising a transmitting-receiving means 25 connected to an aerial means 55, and a particle detecting system 21 connected to the transmitting-receiving means 25. The remote data processing and control

system 13 includes a wireless communication means (a central wireless communication means) 50, having a transmitting-receiving means (a central transmitting-receiving means) 26 connected to an aerial means (a central aerial means) 28, and a microprocessor system 27, which is connected to the transmitting-receiving means 26.

The improved methods of counting and measuring particles provides a wireless transmitting of the control signals from the remote data processing and control system to the remote detecting system and a wireless transmitting of the data (information), characterizing the detected particle parameters, from a remote detecting system to a remote data processing and control system.

An improved apparatus operates as follows. The wireless communicating apparatus for analyzing of environment (see Figs.3, 4, 10) can operate in the three modes: handle service of the data processing and control system 13 by the operator, using a control panel 12 (see Fig.4) of the terminal means 38 of the data processing and control system 13; automatically by a priori programed stages, conditions, regimes and schedule of the operation and/or recorded, for example, on the floppy disk means 9, or on the compact disk means 10 of the microprocessor system 27, or in E-PROM (not shown) of the microprocessor means 6; and the third mode is the different variations of the handle and automatic modes mix.

Regarding the handle mode of the operation, the operator selects the regimes (for example, by control panel 12 from the menu on the displaying means 8) for remote detecting system 5 operation. The control signals from the control panel 12 (see Fig.4) of the terminal means 38 follow by

the multiplexed bus 7 to the microprocessor means 6 of the microprocessor system 27. Referring to automatic mode of the operation, the regimes are selected either by a floppy disk means 9, or by compact disk means 10, or by E-PROM (not shown) and follow by same multiplexed bus 7 to the microprocessor means 6.

Thus, the control signal, processed by microprocessor means 6, via the conversion means 39 of the microprocessor system 27 follow to the transmitting-receiving means 58 of the wireless communication means 56. The signals from the transmitting-receiving means 58 follow to the aerial means 57. The two-way wireless communication means 56 of the remote data processing and control system 13 communicates with the two-way wireless communication means 36 of the remote detecting system 5 (see Figs.3, 4) and the signal from the aerial means 57 are received by the aerial means 34 (see Fig.4) of the wireless communication means 36 and follow via the receiving means 30 of the transmitting-receiving means 3 to the conversion system 31 of the particle detecting system 4 , as shown on Fig.5.

Also referring to Fig.5, the signals from conversion system 31, including a conversion means 64 and a coding-decoding means 51, follow to the particle detecting means 33 via the signal processing system 32. The conversion system 31 provides the conversion of the received signals to the form, acceptable for further processing. Hereby, the signals from the receiving means 30 follow to the conversion means 64, wherein they can be conversed to the digital form intended, for example, for the further use either the multiplexed bus 59, as it is shown on Fig.6 or the

regular connection, as shown on Fig.7. Thereby, the conversed signals from the conversion means 64 follow to the coding-decoding means 51 (see Fig.6). The decoded signals in the digital form from the coding-decoding means 51 follow to the signal processing means 44 and to the control signal conversion means 45, wherein the control signals are conversed to the form required for the control means 43 operation (for example, low power switching means - not shown).

The control means 43 can perform for example, the low power switching functions for the control of the power executive means (not shown) of the environment assaying control means 41 (for example, switching on/off the pump, blower, chamber purging means; switching of the particle size rate means, particle flow control means, etc. - not shown). The assaying air or liquid (water) sample follows by the tubular means 37 from the environment assaying control means 41 to the detection means 40 of the particle detecting means 33.

The particles are detected by the light detecting means 67 of the imaging, or non-imaging means (not shown) of the light detecting system 68 of the detection means 40, belonging to the particle detecting means 33 (see Fig.8). For example, for light detecting system 68, using scattered light detection principles, the signals from light detecting means 67 can be presented by Fig. 9b, where shown the simplified timing diagram $\mathbf{I} = f_1\ (\mathbf{t})$, where: **I** - an output current of the light detecting means 67, **t** - a time. Regarding the primer detected signals, presented on Fig.9b, an equation $\mathbf{I} = f_2\ (\mathbf{E}, \mathbf{F}_1)$ should be considered too. In this equation: **I** - an output current of the

light detecting means 67 (if the primer signals from light detecting means 67 are a current value signals), **E** - a light intensity (a positive polarity of the signals on Figs.9a, 9b is inherent for scattered light detecting principles, but for some other light detecting principles can be negative or can have the different form), $\mathbf{F_1}$ - a physical-technical parameters of the light detecting means 67. Referring to Fig.9a, the primer signals $\mathbf{I = f_1 (t)}$ from the light detecting means 67 depend on the light intensity **E**, which can be presented by a function $\mathbf{E = f_3 (P, D, F_2)}$, where: **P** - a light beam power, **D** - a particle dimensions (sizes), $\mathbf{F_2}$ - the other factors (for example, a particle reflectiveness, a particle permeability, etc.). On Fig.9a is shown the simplified timing diagram $\mathbf{E = f_4 (t)}$.

The signals (Fig.9b) from the light detecting means 67 follow to the current-voltage conversion means 69, where they are conversed to the voltage value signals (Fig.9c), and after the amplifying (Fig.9d) by an amplifying means 70 they follow to the voltage-pulse duration conversion means 71. From the voltage-pulse duration conversion means 71 the signals (Fig.9e) follow to the conjunction means 72, in which also follow strobe pulses (Fig.9f) from the strobe pulse generating means 73. The signals (Fig.9g) from the conjunction means 72, having the strobe pulse packages configuration, follow to the selecting, sorting and counting means 74.

The selecting, sorting and counting means 74 provides selection and sorting of the identical strobe pulse packages (packages within same strobe pulse quantity, that is meaning - with the same strobe pulse package duration τ_i , where $i = 0, 1, 2, ..., k, ..., n$) and also provides the

counting of the identical strobe pulse packages (particle quantity) and the counting of the strobe pulse quantity in the mentioned packages (particle size). The τ_i, characterizes the particle sizes. The longer strobe pulse package (the bigger value of τ_i), the bigger particle size. The higher frequency of the strobe pulses, the higher precision and sensitivity of an improved apparatus. The signals, containing information about particle characteristics, from the selecting, sorting and counting means 74 follow to the constituent parts (blocks) of the signal processing means 44, in which also follow the signals, containing the information, for example, about environmental temperature, humidity, velocity rate, etc. The signals (for example, the coordinating or synchronizing signals) from the signal processing means 44 follow to the control signal conversion means 45 and to the environment assaying control means 41. Also the processed signals, containing the information about particle quantity and dimensions, follow to the coding-decoding means 51 for coding (see Fig.6).

The coded data from the coding-decoding means 51 via conversion means 64 follow to the transmitting means 29 of the transmitting-receiving means 3 (see Fig.5) and further from the transmitting means 3 follow to the aerial means 34 of the wireless communication means 36.

By a wireless communication, the signals, received by the aerial means 57 of the data processing and control system 13, as shown on Fig.4, follow to the receiving means (not shown) of the transmitting-receiving means 58 of the wireless communication means 56. The signals from the transmitting-receiving means 58 follow to the conversion means 39 of the microprocessor system

27 and further the conversed signals follow by the multiplexed bus 7 to the microprocessor means 6 for decoding and the received data processing. The processed information (data), containing the characteristics of the assayed environment (air, gas, liquid or water, for instance), is displayed in the convenient for operator form (e.g., graphics, diagrams, tables, texts, etc.) on the displaying means 8 and/or can be printed by printing means 11.

Referring to Fig.10, an improved apparatus can comprise N = 1, 2, ..., i, ..., n remote detecting systems and, for example, at least one remote data processing and control system. The wireless communication process is the same as described of the above, but the remote data processing and control system 13 serves "N" remote detecting systems (on Fig.10 "N" remote detecting systems are presented by 14, 15, 16, 17). Regarding Fig.10, each remote detecting system 14, 15, 16, 17 includes the appropriate particle detecting system 18, 19, 20, 21 and the appropriate wireless communication means 46, 47, 48, 49, having the appropriate transmitting-receiving means 22, 23, 24, 25 and appropriate aerial means 52, 53, 54, 55. Each remote detecting system has the modified address (code) for the wireless communication, which is recognized by the coding-decoding means included in the conversion system of the each remote detecting system (see, for example, Figs.6, 7) and by the microprocessor system 27 of the remote data processing and control system 13.. Therefore, each remote detecting system operates independently of each other. The remote data processing and control system 13 communicates with the remote detecting systems 14, 15, 16, 17 by central wireless communication means 50, comprising the central

transmitting-receiving means 26 and the central aerial means 28.

The wireless communication can be provided by at least one-way wireless communication from the remote detecting system to the remote data processing and control system, if the remote detecting system includes a programmable means (not shown), or built-in some control means (not shown), or if remote detecting system can work in the permanent predetermined regimes.

Also, the mentioned above wireless communication means and also aerial means, transmitting-receiving mean, transmitting means and receiving means (not shown on Fig.10) can be an identical (can have the same performance).

CONCLUSION, RAMIFICATION AND SCOPE

Accordingly the reader will see that, according to the invention, I have provided an effective methods and apparatus, which provide counting and measuring of the particles of the assayed air (gas) or liquid contaminations.

An improved method of the wireless communicating and apparatus provide authenticity of the real quantity and sizes of the particles in the assayed mixture of air or liquid, because the electro-magnetic noise, creating by wire connection of the particle detecting system with the microprocessor data processing system in the known prior art, is eliminated in an improved apparatus.

Also an improved method of the wireless communicating and apparatus provide the maximal mobility of the remote detecting system. This factor may be very convenient for the improved

apparatus use in the difficult approaching areas, where the operator's activity or the cable (wire) tracing cannot be used.

Additionally, an improved method of the detected signal timing processing, and apparatus provide the increasing of the sensitivity. An improved method makes it possible to achieve sensitivity much less than 0.1μm.

While the above description contains many specificities, these should not construed as limitations on the scope of the invention, but as exemplification of the presently-preferred embodiments thereof. Many other ramifications are possible within the teaching of the invention. For example, an improved method and apparatus provide a maximal portability of the wireless communicating remote detecting system.

Thus, the scope of the invention should be determined by the appended claims and their legal equivalents, and not by examples given.

ABSTRACT

An improved methods and apparatus for analyzing of environment provide a precise counting and measuring of the airborne particle and/or liquid contamination characteristics and include a remote detecting system 5, wireless communicating with a remote data processing and control system 13, having a microprocessor system 27 and a wireless communication means 56, comprising a transmitting-receiving means 58 connected to an aerial means 57. The remote detecting system 5 includes a particle detecting system 4, providing the assaying of environment and the timing processing of the detected signals, and a wireless communication means 36 intended for wireless communication with the remote data processing and control system 13.

CLAIMS

What is the claimed is:

1. A method for a precise analyzing of an environment, providing counting and measuring a particles in said environment, includes the steps of:

detecting said particles by a wireless communicating remote detecting system, comprising a wireless communication means of said wireless communicating remote detecting system and a particle detecting system;

forming in said particle detecting system a data, containing an information about an assayed environment;

conversing said data to a form, which is acceptable for a wireless communication of said wireless communicating remote detecting system with a wireless communicating remote data processing and control system, including a wireless communication means of said wireless communicating remote data processing and control system and a microprocessor system;

wireless communicating between said wireless communicating remote detecting system and said wireless communicating remote data processing and control system;

processing of said data by said wireless communicating remote data processing and control system.

2. The method of claim 1, wherein said wireless communication means of said wireless communicating remote detecting system and said wireless communication means of said wireless communicating remote data processing and control system provide a two-way wireless communication.

3. The method of claim 2, wherein said two-way wireless communication is provided by a transmitting-receiving means of said wireless communication means of said wireless communicating remote detecting system via an aerial means of said wireless communication means of said wireless communicating remote detecting system and by a transmitting-receiving means of said wireless communication means of said wireless communicating remote data processing and control system via an aerial means of said wireless communication means of said wireless communicating remote data processing and control system.

4. The method of claim 2, wherein said two-way wireless communication provides:

a transmitting of a control signals from a wireless communicating remote data processing and control system to a wireless communicating remote detecting system;

a receiving of said control signals by said wireless communicating remote detecting system;

a transmitting of a data from said wireless communicating remote detecting system to

said wireless communicating remote data processing and control system;

a receiving of said data by said wireless communicating remote data processing and control system.

5. An apparatus for a precise analyzing of an environment, including N = 1, 2, ..., i, ...,n, wireless communicating remote detecting systems and a wireless communicating remote data processing and control system, which comprises:

a microprocessor system, including a terminal means, a conversion means of said microprocessor system, a microprocessor means, which are connected to each other by a multiplexed bus;

a wireless communication means, including a transmitting-receiving means, comprising a transmitting means and a receiving means, and an aerial means connected to said transmitting-receiving means.

6. The apparatus of claim 5, wherein said terminal means includes a displaying means, a floppy disk means, a compact disk means, a printing means and a control panel connected to each other by said multiplexed bus.

7. The apparatus of claim 5 wherein said conversion means of said microprocessor system is

connected to a transmitting-receiving means of said wireless communication means.

8. The apparatus of claim 5, wherein said microprocessor system is connected to said wireless communication means.

9. The apparatus of claim 5, wherein said multiplexed bus is presented by a data bus and an address bus.

10. The apparatus of claim 5, wherein each of said N = 1, 2, ..., i, ..., n wireless communicating remote detecting systems, which comprises:

a particle detecting system, including a particle detecting means connected to a signal processing system, which is connected to a conversion system connected to a transmitting-receiving means of said wireless communication means of said wireless communicating remote detecting system;

a wireless communication means, including a transmitting-receiving means, comprising a transmitting means and a receiving means, and an aerial means connected to said transmitting-receiving means.

11. The apparatus of claim 10 wherein said particle detecting means includes a tubular means,

coupling a detection means and an environment assaying control means, wherein said detection system is connected to a detected signal processing means, and wherein said environment assaying control means is connected to a signal processing means and to a control signal conversion means.

12. The apparatus of claim 10 wherein said signal processing system includes a signal processing means connected to a detected signal processing means, to said conversion system and to a control signal conversion means, which is connected to a control means.

13. The apparatus of claim 10 wherein said conversion system includes a conversion means connected to a coding-decoding means.

14. The apparatus of claim 10, wherein said particle detecting system is connected to said wireless communication means.

15. A method for a precise analyzing of an environment, providing a timing processing of a detected signals, containing an information about the particle characteristics, includes the steps of:

conversing said detected signals to a pulse durations, which depend on said particle characteristics; by that forming a different duration pulses;

strobing said different duration pulses by a strobe pulses; thereby forming a strobe pul-

se packages;

counting a quantity of said strobe pulses within said strobe pulse packages;

selecting and sorting said strobe pulse packages by the same said quantity of said strobe pulses within said strobe pulse packages;

counting a quantity of an identical strobe pulse packages.

16. The method of claim 15, wherein said quantity of said strobe pulses within said strobe pulse packages contains an information about particle size.

17. The method of claim 15, wherein said quantity of said identical strobe pulse packages contains an information about particle quantity.

18. An apparatus for a precise analyzing of an environment, providing a timing processing of a detected signals, containing an information about the particle characteristics, includes:

a detection means, comprising a light detecting means;

a detected signal processing means;

a signal processing means.

19. The apparatus of claim 18, wherein said detected signal processing means comprises a

current-voltage conversion means connected to an amplifying means, which is connected to a voltage-pulse duration conversion means.

20. The apparatus of claim 18, wherein said light detecting means is connected to a current-voltage conversion means of said detected signal processing means, and wherein said signal processing means comprises a strobe pulse generating means and a selecting, sorting and counting means, which are connected to a conjunction means, which is connected to a voltage-pulse duration conversion means of said detected signal processing means.

THE DRAWING REFERENCE NUMERALS WORKSHEET

1. - a detector (a prior art);

2. - a parallel processor (a prior art);

3. - a transmitting-receiving means of the wireless communication means 36;

4. - a particle detecting system;

5. - a remote detecting system;

6. - a microprocessor means;

7, - a multiplexed bus of the remote data processing and control system 13;

8. - a displaying means;

9. - a floppy disk means;

10. - a compact disk means;

11. - a printing means;

12. - a control panel;

13. - a remote data processing and control system;

14. - a first remote detecting system;

15. - a second remote detecting system;

16. - an I-th remote detecting system;

17. - a n-th remote detecting system;

18. - a particle detecting system of the first remote detecting system 14;

19. - a particle detecting system of the second remote detecting system 15;

20. - a particle detecting system of the I-th remote detecting system 16;

21. - a particle detecting system of the n-th remote detecting system 17;

22. - a transmitting-receiving means of the first remote detecting system 14;

23. - a transmitting-receiving means of the second remote detecting system 15;

24. - a transmitting-receiving means of the I-the remote detecting system 16;

25. - a transmitting-receiving means of the n-th remote detecting system 17;

26. - a central transmitting-receiving means;

27. - a microprocessor system;

28. - a central aerial means;

29. - a transmitting means;

30. - a receiving means;

31. - a conversion system;

32. - a signal processing system;

33. - a particle detecting means;

34. - an aerial means of the wireless communication means 36;

35. - a wire connection (a prior art);

36. - a wireless communication means of the remote detecting system 5;

37. - a tubular means;

38. - a terminal means;

39. - a conversion means of the microprocessor system 27;

40. - a detection means;

41. - an environment assaying control means;

42. - a detected signal processing means;

43. - a control means;

44. - a signal processing means;

45. - a control signal conversion means;

46. - a wireless communication means of the first remote detecting system 14;

47. - a wireless communication means of the second remote detecting system 15;

48. - a wireless communication means of the I-th remote detecting system 16;

49. - a wireless communication means of the n-th remote detecting system 17;

50. - a central wireless communication means;

51. - a coding-decoding means;

52. - an aerial means of the first remote detecting system 14;

53. - an aerial means of the second remote detecting system 15;

54. - an aerial means of the I-th remote detecting system 16;

55. - an aerial means of the n-th remote detecting system 17;

56. - a wireless communication means of the remote data processing and control system 13;

57. - an aerial means of the wireless communication means 56;

58. - a transmitting-receiving means of the wireless communication means 56;

59. - a multiplexed bus of the remote detecting system 5;

60. - a detection unit (a prior art);

61. - an amplifier (a prior art);

62. - a comparator (a prior art);

63. - a reference voltage means (a prior art);

64. - a conversion means of the conversion system 31.

65. - a control logic (a prior art);

66. - a pulse height analyzer (a prior art);

67. - a light detecting means;

68. - a light detecting system;

69. - a current-voltage conversion means;

70. - an amplifying means

71. - a voltage-pulse duration conversion means;

72. - a conjunction means;

73. - a strobe pulse generating means;

74. - a selecting, sorting and counting means;

75. - a sensor (a prior art);

76. - a microprocessor (a prior art).

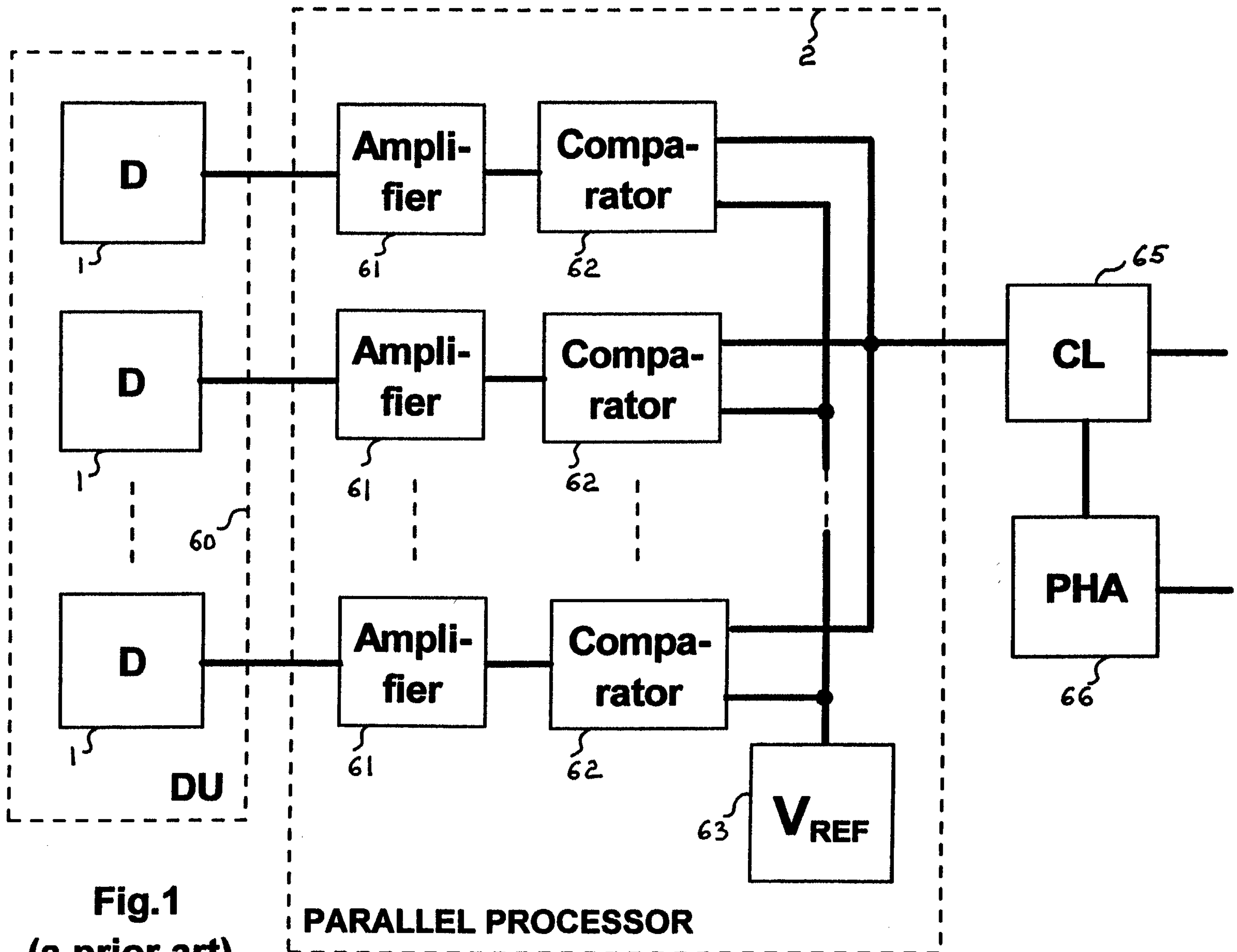


Fig.1
(a prior art)

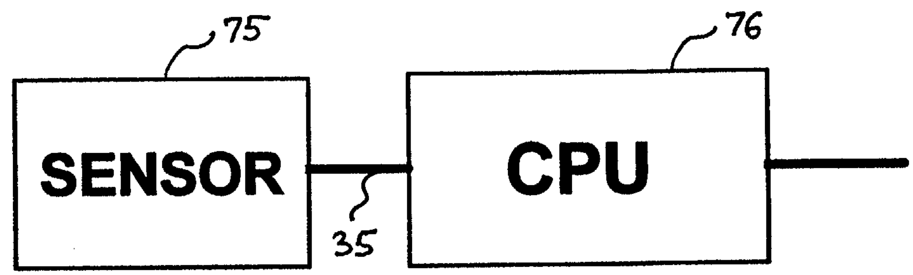


Fig. 2
(a prior art)

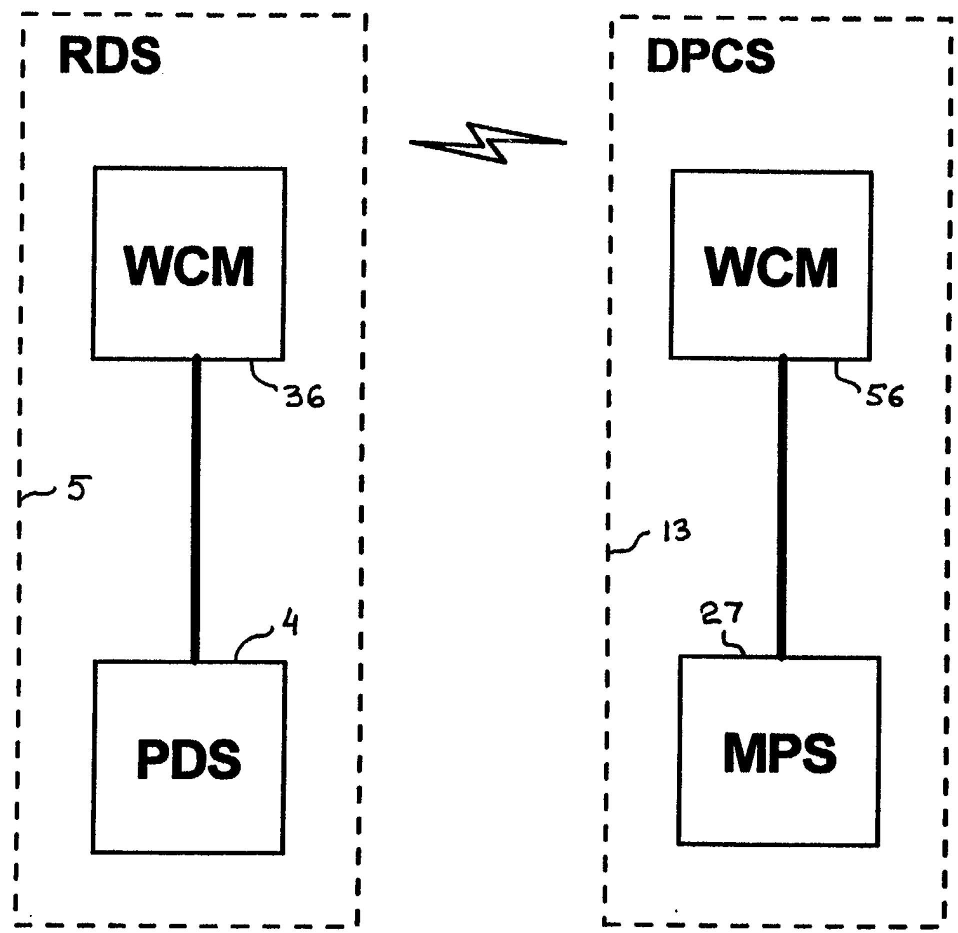
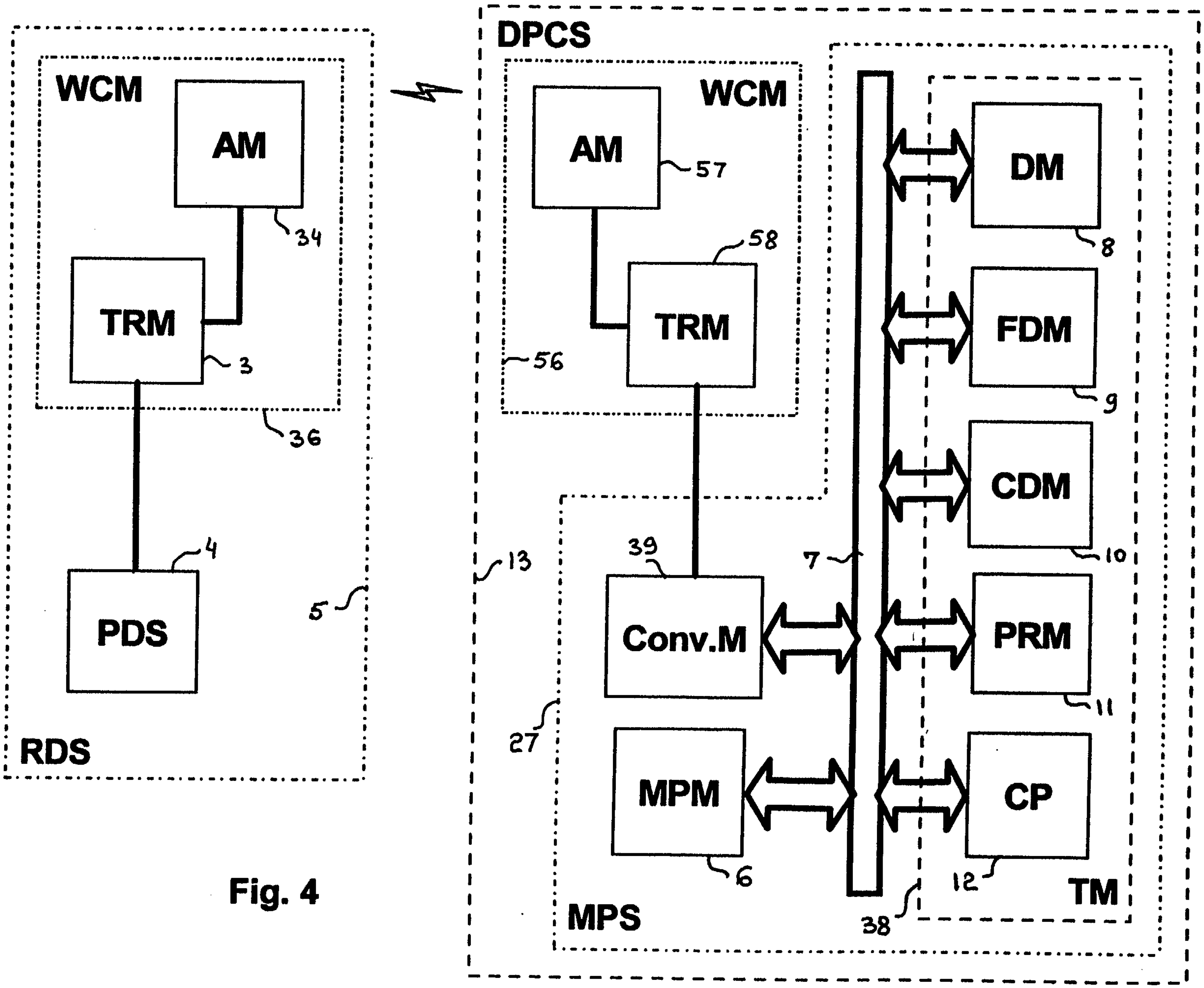


Fig. 3



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3
36
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RDS
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PRM
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TM

Fig. 4

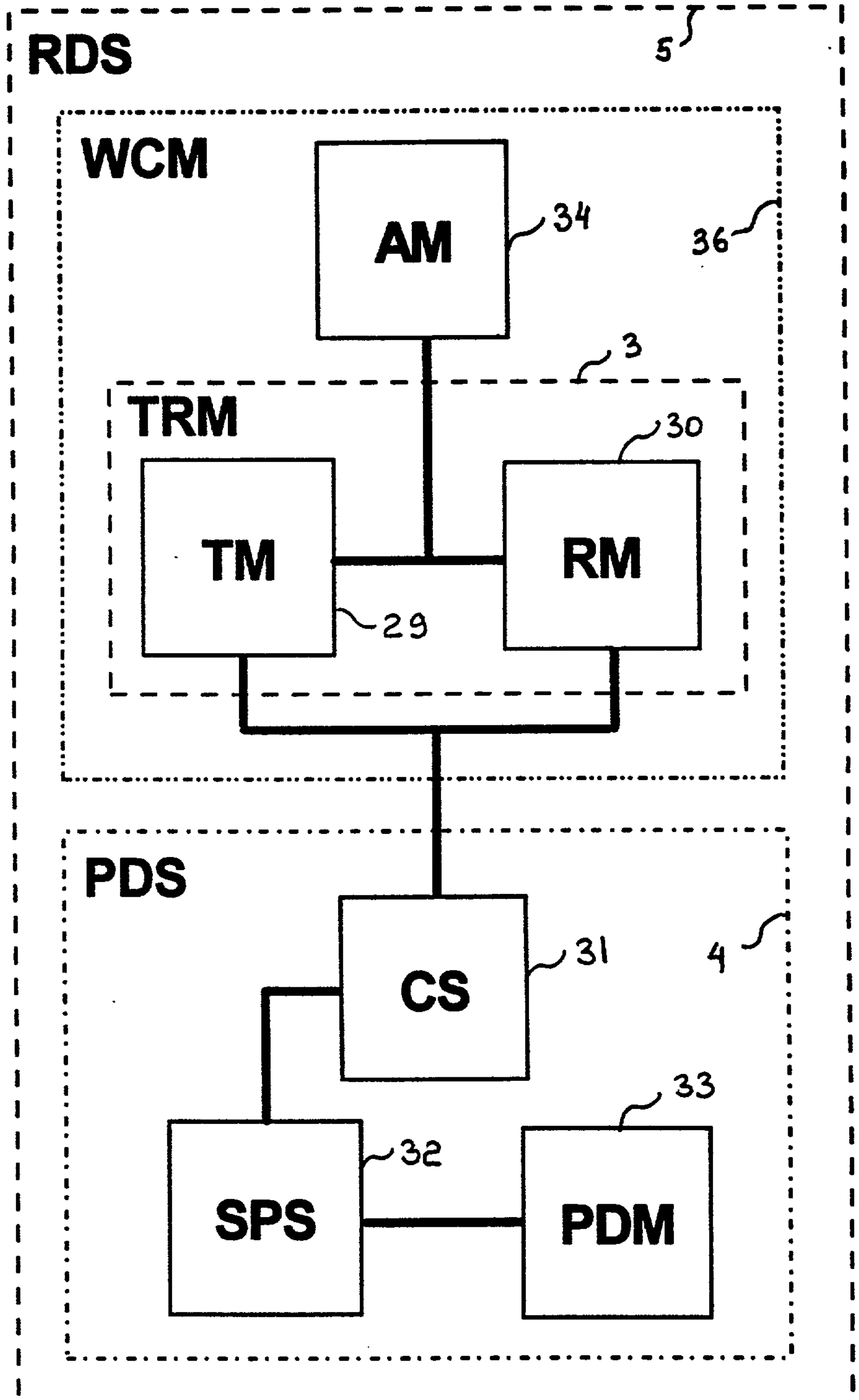

Fig. 5

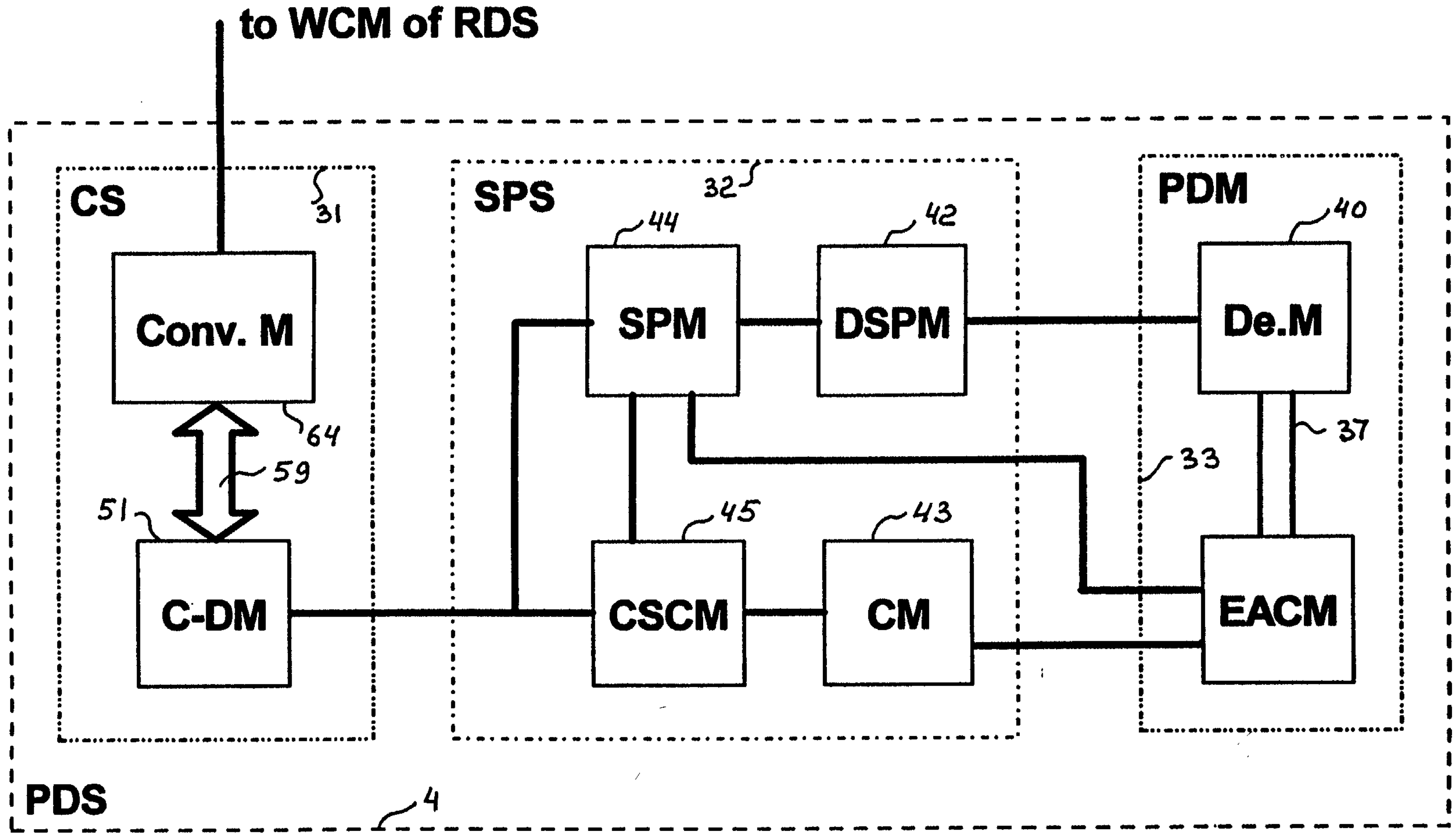
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Fig. 6

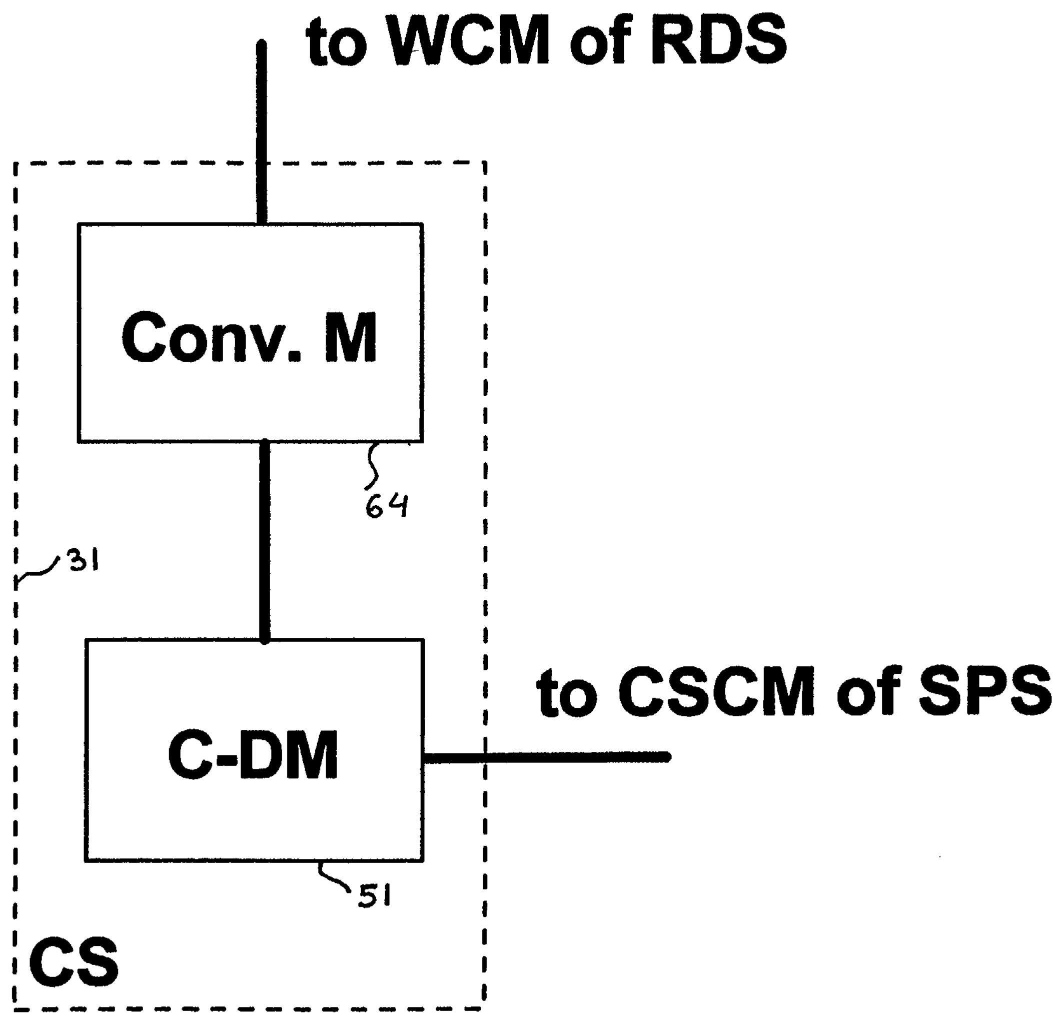
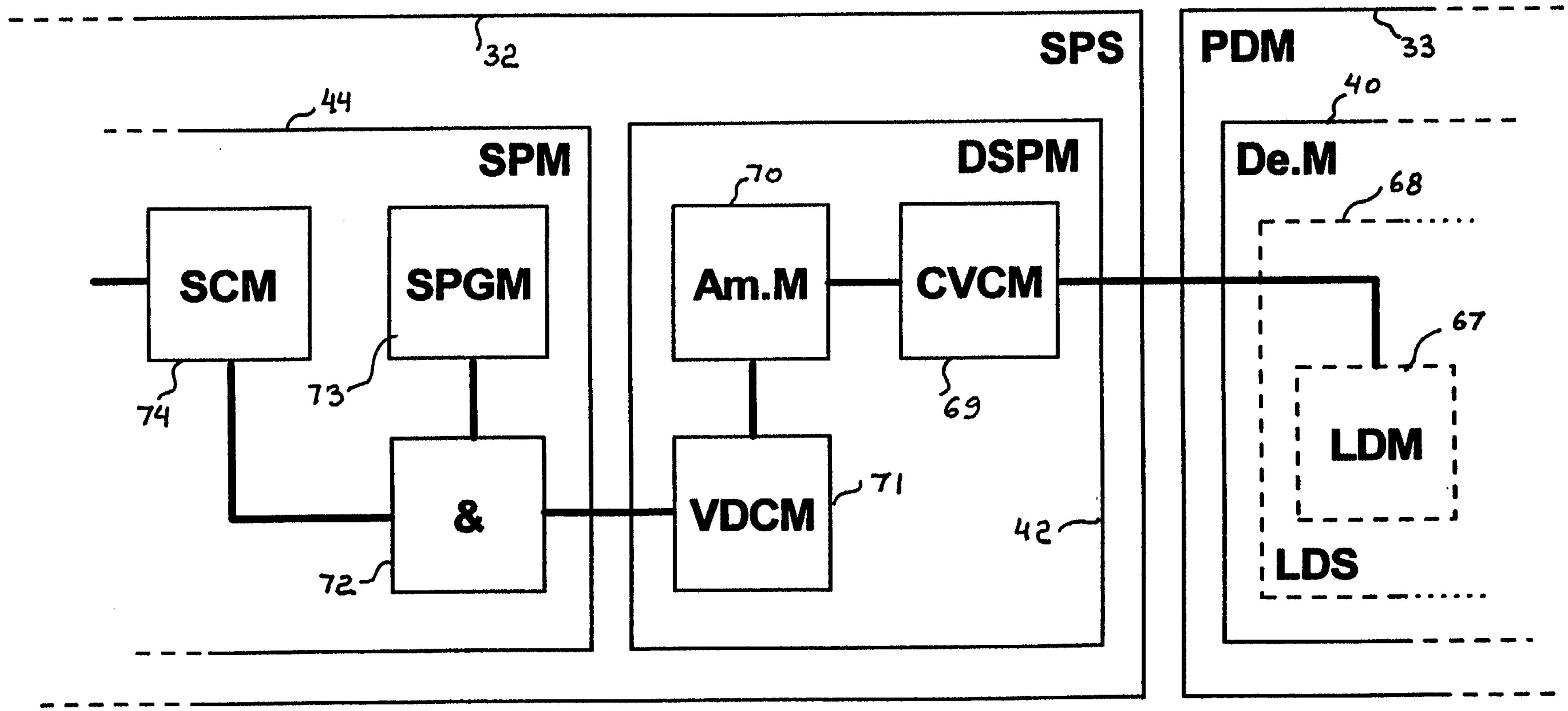


Fig.7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LDS

Fig.8

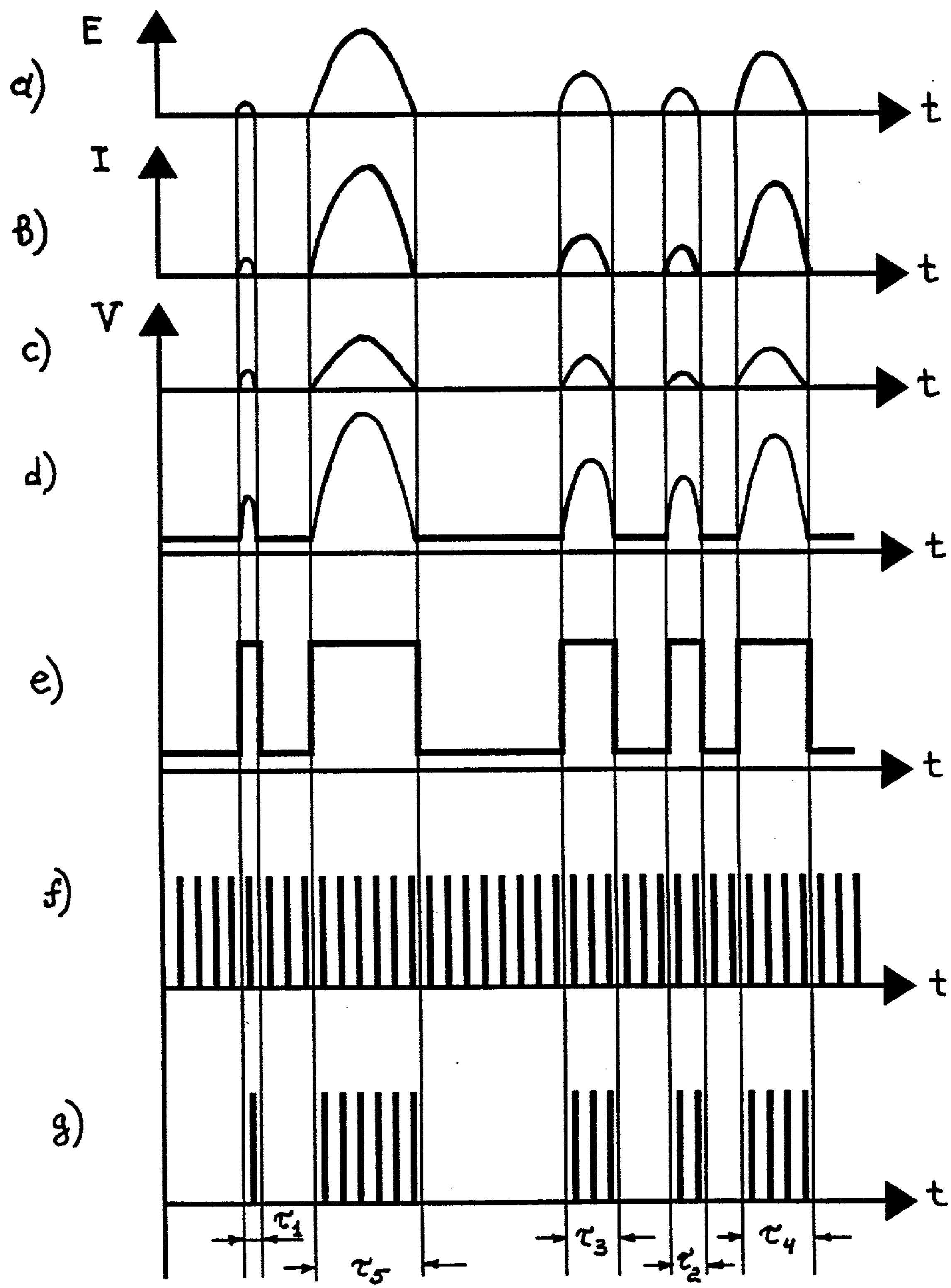
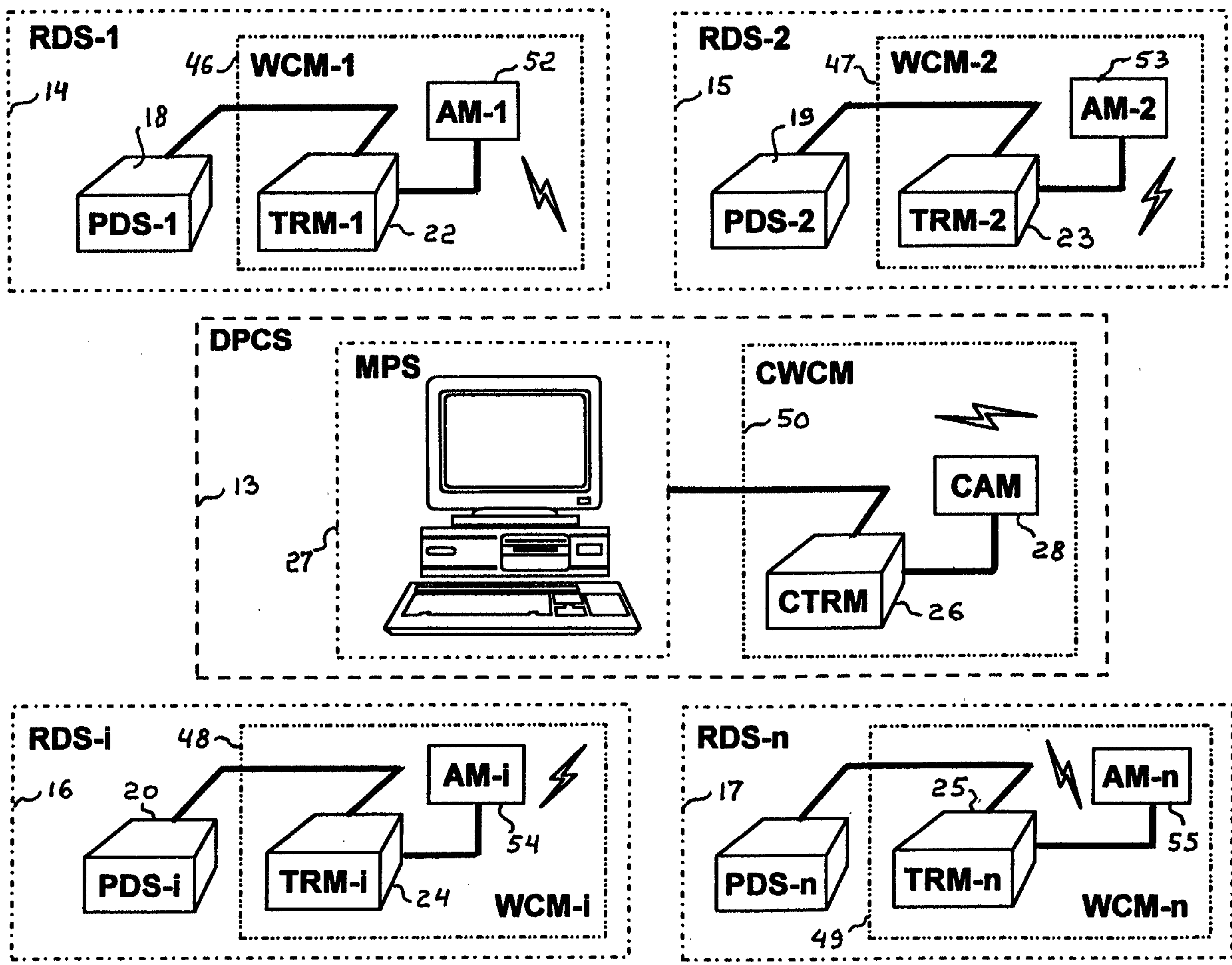


Fig. 9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TRM-i
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WCM-i
RDS-n
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25
AM-n
55
PDS-n
TRM-n
WCM-n
49

Fig. 10